

Occasional Papers On Mollusks

JUN 2 1972

Published by

THE DEPARTMENT OF MOLLUSKS HARVARD
Museum of Comparative Zoölogy, Harvard University UNIVERSITY
Cambridge, Massachusetts

VOLUME 3

JUNE 2, 1972

NUMBER 44

NOTES ON THE GENUS CHITON IN
THE WESTERN INDIAN OCEAN
(MOLLUSCA: POLYPLACOPHORA)*By* ROBERT C. BULLOCK

A number of *Chiton* species have been reported from the Indian Ocean, but only four are recognized, including two apparently undescribed species. The species endemic to South Africa and those referable to the genus *Rhyssoplax* are not included in this report.

The following abbreviations are used in the synonymies and the distribution records of this paper:

- AMS Australian Museum, Sydney
 ANSP Academy of Natural Sciences of Philadelphia
 BMNH British Museum (Natural History), London
 DMNH Delaware Museum of Natural History, Greenville
 MCZ Museum of Comparative Zoology, Harvard University
 MHNH Musée royal d'Histoire naturelle de Belgique
 MNHNP Muséum national d'Histoire naturelle, Paris
 RNHL Rijksmuseum van Natuurlijke Historie, Leiden
 USNM U. S. National Museum of Natural History
 ZMA Zoological Museum, Amsterdam
 ZMHU Zoological Museum, Humboldt University, Berlin
 ZMK Universitetets Zoologiske Museum, Copenhagen

Chiton peregrinus Thiele 1910

Plate 44, figures 1, 2, 10

Chiton (Clathropleura) peregrinus Thiele 1910, Zoologica 22: 90, pl. 9, figs. 32-37 (Algoa-Bai [South Africa, herein corrected to Aden]; type in ZMHU).

Chiton lamyi Dupuis 1917, Bull. Mus. Hist. Nat., Paris, 23: 538 (Obock, Aden; type material present in BMNH and MNHNP*); Dupuis 1918, Bull. Mus. Hist. Nat., Paris, 24: 531.

Chiton lamyi, var. *peregrinus* Thiele. Dupuis 1918, Bull. Mus. Hist. Nat., Paris, 24: 532.

Chiton lamyi, var. *reticulatus* Dupuis 1918, Bull. Mus. Hist. Nat., Paris, 24: 532 (Mer Rouge; location of type unknown). Non *C. reticulatus* Reeve 1847 or Nierstrasz 1905.

Chiton wallacei Winckworth 1927, Proc. Malac. Soc. London, 17: 206, pl. 29, figs. 5-8 (Aden; type in BMNH).

Chiton iatricus Winckworth 1930, Proc. Malac. Soc. London, 19: 78, pl. 8b (East Pier at Karachi [West Pakistan]; type BMNH 1952.11.11.225).

Chiton iatricus, var. *winckworthi* Kaas 1954, Zool. Mededl., 33: 2 (beach, 2½ miles N of Bhuleji abb., 20 miles W of Karachi [West Pakistan]; type in collection of P. Kaas and A. N. Ch. ten Broek, no. 3416).

Chiton peregrinus Thiele. Leloup 1955, Bull. Inst. Roy. Sci. Nat. Belgique, 31 (42): 4, fig. 3.

Remarks: The number of names applied to this species, the manner in which these names were introduced, and their subsequent citation, or lack of it, in the literature thereafter, reflect the complexities of polyplacophoran nomenclature. *C. peregrinus* was described by Thiele

*Some syntype material which should be in Paris is now in the Dautzenberg collection in Bruxelles, making the selection of lectotypes difficult. Iredale and Hull (1932) have commented on the problems faced when dealing with Paris Museum types.

(1910) from Algoa Bay, South Africa, an erroneous locality. Ashby (1931) and Barnard (1963), in their reports on the Polyplacophora of South Africa, failed to mention this species. Dupuis (1917, 1918), Winckworth (1927, 1930), and Kaas (1954) created additional names due to their lack of understanding in dealing with intraspecific variation and ignorance of the literature. Leloup (1955) correctly pointed out the identity of *C. iutricus*, but omitted any mention of Dupuis' species and *C. wallacei* Winckworth.

C. peregrinus is found in rocky areas. It has been taken from rock pools at Aden (Winckworth 1927) and rocks forming the East Pier at Karachi, West Pakistan, where it was found in association with *Nerita textilis* Gmelin, *Siphonaria*, and a *Patella* (Winckworth 1930).

C. peregrinus is often heavily fouled and eroded, particularly larger individuals, and in this state it is difficult to distinguish this species from *C. salihafui*, an east African species which is also commonly collected in an eroded state (see remarks under *C. salihafui*).

Distribution: *Chiton peregrinus* is widely distributed along the northern margin of the western Indian Ocean (see Pl. 43). It occurs from the northern coast of western India to the Persian Gulf and westward to the entrance of the Red Sea. This species is replaced along the east African coast by *Chiton salihafui*.

Specimens examined: FRENCH SOMALILAND: Obock (MHNH). ADEN: Perim (MNHNP); Aden (BMNH, MNHNP); Modern Bandar Sheikh, Little Aden. MUSCAT: (BMNH, ZMA). IRAN: Bushehr (BMNH); 6 km S of Bushehr (ZMK); Tavila (ZMK). PAKISTAN: NW end of Astola Id. (MCZ); Manora Id., Karachi (BMNH, MCZ); 200 yds. W of Mandir, Manora Id., Karachi (RNHL); East Pier, Karachi (BMNH, MHNH, MNHNP, ZMA, AMS). INDIA: Port Okha, Kathiwar, Gujarat (USNM).

Chiton salihafui, new species

Plate 44, figures 3-5

Chiton (Clathropleura) tenuistriatus 'Sowerby' Thiele 1910, *Zoologica*, 22: 90, pl. 9, figs. 38-40. Non *C. tenuistriatus* Sowerby 1840.

Type locality: Kendwa Island, about 4 miles ESE of Dar-es-Salaam, Eastern Province, Tanzania.

Type depositories: Holotype, MCZ 279163; paratypes: from type locality (MCZ 279164); Whale Id., Kenya (BMNH); Ras Ngomeni, Kenya (BMNH); Turtle Bay, Kenya (BMNH); Mboa Maji, Eastern Province, Tanzania (MCZ 279165).

Other material examined: Mogadishu, Somali Republic (MCZ); Madagascar (ZMHU); Tamatave, Madagascar (ZMHU); Pointe Ibanona, Fort Dauphin, Madagascar (MCZ); Flacourt, Ft. Dauphin, Madagascar (ANSP, MCZ); Ft. Dauphin, Madagascar (ANSP); island, $\frac{3}{4}$ mi NE of Manafiafy girls school, Ste. Lucie, Madagascar (MCZ); two islands, $\frac{1}{4}$ mi E of Manafiafy girls school, Ste. Lucie, Madagascar (MCZ).

Distribution: *Chiton salihafui* occurs along the east African coast from the Somali Republic south to Tanzania and Madagascar (see Pl. 43).

Description: Animal of moderate size, attaining a length of 38 mm, a width of 31 mm. Angle of valves about 90°. Anterior valve slightly convex; post-mucral slope straight to somewhat concave. Jugal region rather smooth; central areas with regular, low, longitudinal ribs. Lateral triangle slightly raised, with 4-5 broad, radiating ribs. End valves with 20-22 radiating ribs; ribs obsolete in very old animals. Numerous small concentric ribs present between these radiating ribs. Shell generally greenish gray, occasionally greenish brown. Some specimens cream-white in central areas with small splotches of greenish brown and

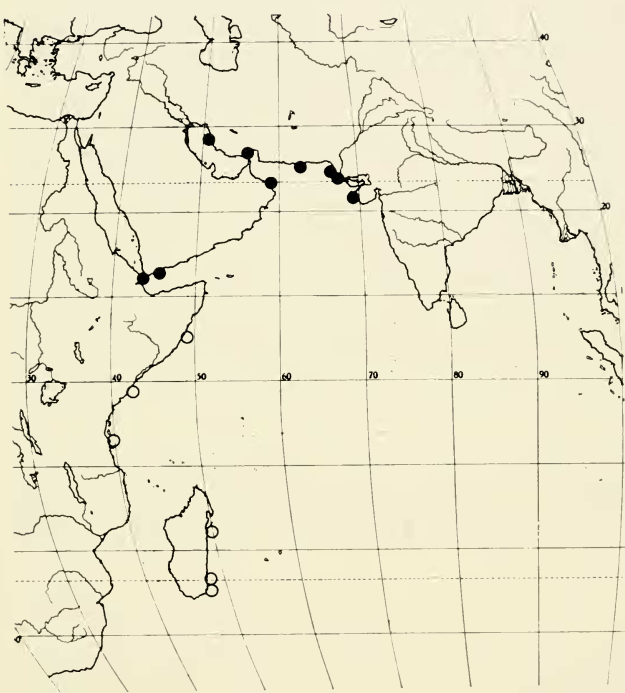


Plate 43

Distribution of the northern *Chiton peregrinus* Thiele [●] and the east African *Chiton salihafui*, n. sp. [O].

with 2 prominent longitudinal brown streaks across jugal region. Girdle with prominent scales and alternately banded with light and dark. Interior of shell whitish; anterior slope of callus light blue-green; muscle scars very light brown and light brown streaks extending from the mucral region toward lateral portions of callus.

Insertion plates: Apophyses broad, moderately extended, more so medially than laterally. Jugal sinus trapezoidal; 8-11 jugal teeth, becoming broader laterally and faintly grooved dorsally and ventrally. No aesthete canals between jugal teeth. A single insertion slit; insertion teeth deeply pectinate. Eaves spongy.

Hypostracum: Central depression of intermediate valves of young specimens with a very few scattered slits oriented perpendicular to longitudinal axis; slits apparently lacking in older specimens. Callus developed. Functional slit-ray present. Anterior valve with 11 teeth; posterior valve with 13 teeth; interior aesthete slits lacking, except in young specimens.

Girdle elements: Scales of moderate size, smooth, squarish with slightly rounded dorsal surface; no lateral ridge. Base diamond-shaped, rounded medially, slightly concave. Medial portion deeply concave, no medial ridge present.

Remarks: The only previous reference in the literature to this species is that given by Thiele (1910), who stated it to be *Chiton tenuistriatus* Sowerby, a species which has remained unrecognized. Pilsbry (1893: 188) had considered Sowerby's species a typical *Chiton*, "closely allied to *quoyi* [Deshayes 1836 = *glaucus* Gray 1828] or *nigrovirens*. . . ." After examining numerous *Chiton* species, I feel with certainty that the brief description (Sowerby 1840b) and the figure in the Conchological Illustrations (Sowerby 1840a) refer to the common neozelanic species, *Chiton glaucus* Gray 1828. The Madagascar-East African species is therefore without a name and it is herein named *Chiton salihafui* in honor of Mr. Samuel Liberty Harvey Fuller who collected this species.

C. salihafui is most closely related to the northern *C. peregrinus* to which, in its usually worn, eroded, and fouled state, it appears identical. Examination of younger and well preserved specimens has revealed important distinctions between the two species. *C. salihafui* differs by possessing longitudinal lirae on the central area of the valves, having prominent radial ribs on the end valves, having more substantial and somewhat squarish or evenly rounded radiating ribs on the lateral triangle, and having a smooth jugal region. In young *C. peregrinus* the valves are flatter, the jugal and central regions are devoid of longitudinal lirae, and the tegmental surface is of irregular, close-packed rows of granules (Pl. 44, fig. 10). The terminal areas of older *C. peregrinus* appear smooth, except for a slightly raised reticular pattern in some specimens. Very old animals of both species are very similar in appearance, for the older, more characteristic portions of the tegmentum are eroded and the newer tegmental structure is often quite smooth in both species.

C. mauritanus, a Mascarene species, differs from *C. salihafui* by its smooth, more rounded valves and by the fact that the longitudinal lirae, or grooves, of the central area extend but a short distance from the lateral triangle.

***Chiton mauritanus* Quoy & Gaimard 1835**

Chiton mauritanus Quoy & Gaimard 1835, Voy. de l'Astrolabe (Zool.), 3: 397, pl. 73, figs. 1-3 (l'Ile-de-France [= Mauritius Id., Mascarene Islands]; one syntype in MHN, other syntypes possibly in MNHN); Pilsbry 1893, Man. Conch. 14: 188, pl. 31, figs. 39, 40; Dupuis 1918, Bull. Mus. Hist. Nat., Paris, 24: 528.

Chiton angusticostatus Quoy & Gaimard 1835, Voy. de l'Astrolabe (Zool.), 3: 398, pl. 73, figs. 4, 4' (l'Ile-de-France [= Mauritius Id., Mascarene Islands]; type in MNHN); Pilsbry 1893, Man. Conch., 14: 187, pl. 31, figs. 37, 38.

Chiton rusticus Deshayes 1863, Moll. Réunion, p. 39, pl. 6, figs. 1-3 (l'île de la Réunion [Mascarene Islands]; location of type unknown); Pilsbry 1893, Man. Conch., 14: 186, pl. 31, figs. 32-34; Hodgkin & Michel 1963, Proc. Roy. Arts Sci. Mauritius, 2: 121-145 [notes on habitat].

Chiton (Lepidopleurus) mauritianus Quoy & Gaimard. von Martens 1880, [in] Möbius, Beiträge Meeresfauna Mauritius und Seychellen, p. 300.

Chiton (Lepidopleurus) angusticostatus Quoy & Gaimard. von Martens 1880, *Ibid.*, p. 300.

Chiton (Lepidopleurus) rusticus Deshayes. von Martens 1880, *Ibid.*, p. 300.

Georgus rusticus (Deshayes). Thiele 1893, [in] Troschel, Das Gebiss der Schnecken, 2: 367, pl. 30, fig. 14.

Lepidopleurus mauritianus (Quoy & Gaimard). Viader 1937, Mauritius Inst. Bull., 1(2): 58.

Lepidopleurus angusticostatus (Quoy & Gaimard). Viader 1937, *Ibid.*, p. 58.

Lepidopleurus rusticus (Deshayes). Viader 1937, *Ibid.*, p. 58.

Remarks: Both *C. mauritianus* and *C. angusticostatus* were described by Quoy & Gaimard (1835) from material collected during the voyage of the *Astrolabe*. The fact that the figured type of *C. angusticostatus* is a rather large, very worn chiton contributed to the misunderstanding concerning its identity. Pilsbry (1893) suggested it was "merely a greatly worn specimen of *C. pellisserpentis* Q. & G.," a neozelanic species.

Thiele (1909) first noted that *C. rusticus* Deshayes 1863 was a junior synonym of *C. angusticostatus*. Dupuis (1918) pointed out that *C. mauritianus* was also conspecific and decided it was the valid name by page priority. Examination of type specimens of *C. angusticostatus* and *C. mauritianus* and the original figures of *C. rusticus* has led me to concur with Dupuis' conclusions. It should be mentioned that the single "syntype" of *C. mauritianus* present

in the Muséum national d'Histoire naturelle, Paris, does not compare with the illustration of this species and represents a species of *Sclerochiton*, a group which has not been reported from the Mascarene Islands.

Older examples of *C. mauritianus* are usually quite eroded and might possibly be confused with worn specimens of *C. salihafui* or *C. peregrinus*. Young *C. mauritianus* can easily be distinguished from all other Indian Ocean *Chiton* by their bluish green color, the slightly raised reticular pattern on the lateral triangles and end valves, the sometimes translucent blue-green girdle scales, the more rounded valves, and the longitudinal lirae on the central areas which are limited to the region near the lateral triangle. Also, the mucro is more pronounced and blunt than in most chitons.

On Mauritius, *Chiton mauritianus* is found in rocky areas and on the steeper faces above and below the limestone reef platform, where it is absent (Hodgkin & Michel 1963).

Distribution: Known only from the Mascarene and Seychelle Islands.

Specimens examined: MASCARENE ISLANDS: La Réunion (BMNH, MHNB, MNHNP); Mauritius (BMNH, ZMHU, MHNB, MNHNP); below lighthouse, Caves Pt. (ANSP); Sovillac (ANSP). SEYCHELLE ISLANDS: Mahé (BMNH); Barbarons, Mahé (BMNH).

***Chiton fosteri*, new species**

Plate 44, figures 6-9

Type locality: Ankoalamare, 3 miles SE of Ambodifotra, E coast, Ile Ste. Marie, Madagascar.

Type depositories: Holotype, MCZ 279166; paratypes: Reef near cliffs at S end of Sarodrano Point, 12½ miles

SSW of Tulear, SW Madagascar (MCZ 279167); 2½ miles NE of Pointe d'Antsiraikiraiky, NW Ile Ste. Marie, NE Madagascar (MCZ 279168); Kilifi, Kenya (BMNH); near lighthouse, Mkunduchi, SE Zanzibar (ANSP 213022); off-shore reef, Pwani Mchangani, Zanzibar (ANSP 212570); Kiwengwa, Zanzibar (ANSP 212257, MCZ 279312); Ras Nungwe, Zanzibar (ANSP).

Description: Animal small to medium in size, attaining a length of 34 mm, a width of 19 mm. Angle of valves 120°-140°. Anterior valve slightly convex; post-mucral region of posterior valve straight. Jugal region and central areas smooth. Lateral triangle smooth, depressed, concave in immature examples, slightly convex in older ones, and bordered anteriorly and posteriorly by a weak ridge. Shell color usually light greenish yellow with narrow longitudinal green stripes and light brownish flecks in jugal and central regions; lateral triangles, anterior valve, and post-mucral region of posterior valve conspicuously banded with concentric brown bands. Some specimens from Zanzibar very darkly colored with concentric brown bands obscured. Girdle with prominent scales, white, and irregularly flecked with light brown, reddish brown, and orange. Dark specimens with a dark girdle.

Insertion plates: Apophyses broad, moderately extended; anterior edge with two depressions, one at center of apophysis, other near anterior insertion tooth. Jugal sinus trapezoidal; 10-12 irregular teeth. A single insertion slit; insertion teeth deeply pectinate. Eaves spongy.

Hypostracum: Central callus of intermediate valves well developed, with close-packed, elongate slits perpendicular to longitudinal axis on anterior slope. Functional slit-ray present; slits single, larger and elongate on callus near insertion plate, smaller and more rounded in posterior depression. Anterior valve with 9 teeth; posterior valve with 16 teeth.

Girdle elements: Scales of moderate size, appearing smooth, but with several obscure striations at pointed

mucro. Base elongate-diamond-shaped, flat, with no surrounding callus; medial surface deeply concave.

Remarks: The number of specimens examined and the fact that this species has been collected from a number of localities in the southwestern Indian Ocean makes one wonder why this species has remained uncollected and undescribed. Outside of collections from Zanzibar sponsored by the Academy of Natural Sciences of Philadelphia (1957) and on Madagascar made by Richard W. Foster of the Museum of Comparative Zoology (1960), only one additional specimen was available for study, collected by a recent British expedition to Kenya.

The smoothness of the dorsal shell areas, the concentric brown bands on the lateral triangle and end valves, the flatness of the shell, and the greater number of insertion teeth on the posterior valve serve to distinguish this species from *C. peregrinus*, *C. salihafui*, and *C. mauritianus*.

This species is named in honor of the late Richard W. Foster whose enthusiasm and encouragement contributed greatly to my interest in molluscan systematics.

ACKNOWLEDGMENTS

For the loan of specimens, I thank Drs. R. T. Abbott, J. Knudsen, E. Leloup, B. Métivier, W. Ponder, R. Robertson, J. Rosewater, and J. Taylor. Funds enabling the author to visit European collections were provided by: National Science Foundation grant GB 27911, Dr. Reed Rollins, principal investigator; the Biology Department, Harvard University; and a Sigma Xi Grant-in-Aid-of-Research.

My colleagues in the Museum of Comparative Zoology, Dr. K. J. Boss, Dr. R. D. Turner, and Mr. R. I. Johnson, critically read several drafts of this paper and offered many helpful comments.

Plate 44

Figs. 1, 2, 10. *Chiton peregrinus* Thiele. Manora Creek, Karachi, West Pakistan. MCZ 200542 (coated valves of young specimen to show granulation of tegmentum; width valve IV, 9.5 mm).

Figs. 3-5. *Chiton salihafui*, new species. Kendwa Island, abt. 4 mi ESE of Dar-es-Salaam, Eastern Province, Tanzania. Holotype MCZ 279163 (valves coated; width valve IV, 16 mm).

Figs. 6-8. *Chiton fosteri*, new species. Ankoalamare, 3 mi SE of Ambodifototra, E coast, Ile St. Marie, Madagascar. Holotype MCZ 279166 (valves coated; width valve V, 11 mm).

Fig. 9. *Chiton fosteri*, new species. Offshore reef, Pwani Mchangani, NE Zanzibar. Paratype ANSP 212570 (uncoated specimen to show color pattern; length 31 mm).

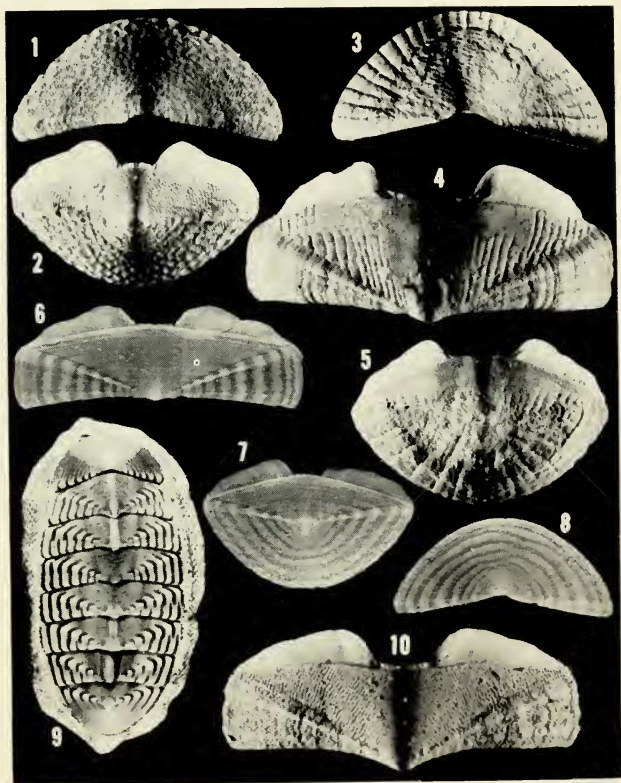


Plate 44

REFERENCES CITED

- ASHBY, E. 1931. Monograph of the South African Polyplacophora (Chitons). *Ann. South African Mus.*, 30 (1): 1-59, 7 pls.
- BARNARD, K. H. 1963. Contributions to the knowledge of South African marine Mollusca. Part IV. Gastropoda: Prosobranchiata: Rhipidoglossa, Docoglossa. Tectibranchiata. Polyplacophora. Solenogastres. Scaphopoda. *Ann. South African Mus.* 47: 201-360.
- DESHAYES, G. P. 1863. Catalogue des Mollusques de l'Île de la Réunion (Bourbon). [in] L. Maillard, Notes sur l'Île de la Réunion, annexe E, 144 pp., pls. 28-41.
- DUPUIS, P. 1917. Notes prises au cours de l'examen de la collection de polyplacophores du Muséum de Paris. *Bull. Mus. Hist. Nat., Paris*, 23: 533-538.
- DUPUIS, P. 1918. Notes concernant les polyplacophores (suite). *Bull. Mus. Hist. Nat., Paris*, 24: 525-533.
- HODGKIN, E. P. and C. MICHEL. 1963. Zonation of plants and animals on rocky shores of Mauritius. *Proc. Roy. Soc. Arts Sci. Mauritius*, 2: 121-145, 2 tables, figs., pl. 4.
- IREDALE, T. & A. F. B. HULL. 1932. The loricates of the Neozelanic region [con't.]. *Australian Zoologist*, 7: 119-164, pls. 7-10.
- KAAS, P. 1954. Report on a collection of Loricata from Manora Island, Karachi, with descriptions of three new species and a new variety. *Zoologische Mededelingen, Leiden*, 33 (1): 1-9, 14 figs.
- LELOUF, E. 1942. Contribution a la connaissance des polyplacophores, I. Famille Mopaliidae Pilsbry 1892. *Mém. Mus. Roy. Hist. Belgique*, 2nd ser., no. 25, 64 pp., 6 pls.
- LELOUF, E. 1955. A propos de *Chiton heterodon* (Pilsbry, 1892) et de *Chiton peregrinus* Thiele, 1910. *Bull. Inst. Roy. Sci. Nat. Belgique*, 31 (42), 7 pp., 3 figs.
- MARTENS, E. VON. 1880. Mollusken. [in] K. Möbius, Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen, pp. 179-352, pls. 19-22.
- PILSBRY, H. A. 1892-1894. Polyplacophora. *Manual of Conchology*, 14, i-xxxiv 350 pp.; 15, pp. 1-333, pls. 1-17.
- QUOY, J. R. C. and J. P. GAIMARD. 1835. Mollusques. *Voyage de l'Astrolabe (Zool.)*, 3: 1-644, 93 pls.
- SOWERBY, G. B. 1840a. A catalogue of the Recent species of chitons. *Conchological Illustrations*, 10 pp., 26 pls.
- SOWERBY, G. B. 1840b. Descriptions of some new chitons. *Charlesworth's Mag. Nat. Hist., (n. s.)* 4: 287-294 [refers to figures in *Conch. Illust.*].

- THIELE, J. 1893. Polyplacophora. [in] F. H. Troschel, *Das Gebiss der Schnecken*, 2: 353-401, pls. 30-32.
- THIELE, J. 1909-1910. *Revision des Systems der Chitonen*. *Zoologica*, 22: (I) 1-70, pls. 1-6 (1909); (II) 71-132, pls. 7-10 (1910).
- WINCKWORTH, R. 1927. New species of chitons from Aden and South India. *Proc. Malac. Soc. London*, 17: 206-208, pls. 28, 29.
- WINCKWORTH, R. 1930. Description of a new *Chiton* from Karachi. *Proc. Malac. Soc. London*, 19: 78-80, pl. 8b.

BOOK REVIEW

THORSON, GUNNAR. 1971. *Life in the Sea*. World University Library, McGraw Hill Book Co., New York, Toronto, 256 pp., numerous illustrations. \$2.45.

This beautifully illustrated book was designed to introduce the non-professional reader to some of the fascinating aspects of marine life. The book outlines the basic concepts of marine biology and makes them vivid through the inclusion of numerous intriguing examples.

Part I of the book, after a brief discussion of the physical and chemical nature of the oceans, gives a very general account of the various kinds of plants and animals which make up the plankton, nekton and benthos. There is also a discussion of the various light zones and the communities which typify them. Part II is a more detailed discussion of the different habitats found in the ocean, from the supralittoral to the deep-sea benthic. Here the animals and plants of the various ecologic communities are discussed in more detail; the behavior and interactions of species are also described. Throughout the book, classic experiments which resolved important questions are included to give the reader an insight into the nature of scientific research. In addition to the interesting and smoothly reading text, Dr. Thorson has included numerous informative photographs, figures and diagrams.

This book does not pretend to provide a systematic and complete account of ocean life. General invertebrate taxonomy is largely ignored; although binomial nomenclature

is used consistently, higher scientific taxa, including phyla, are for the most part omitted. For example, when discussing arrow worms, the phylum Chaetognatha is never mentioned. An appendix with a basic classification scheme would have been helpful for those interested in the phylogenetic relationships among the invertebrates.

The scope of the book is broad, and by necessity coverage of many areas is superficial. Yet these limitations did not prevent Dr. Thorson from creating a book which will stimulate the student to further explore the realm of marine biology.

— N. Knowlton